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ACHIEVEMENTS IN NEUTRON PHYSICS, NUCLEAR ENERGY RESEARCH

Sofia FIZIKO-MATEMATICHESKO SPISANIE in Bulgarian No 4, 1982 pp 246-256

[Article by V. Khristov: "Fifty Years since Discovery of Neutron"]

[Excerpt] In Bulgaria the first IRT-2000 research reactor was built with the fraternal help of the USSR and went into operation about 20 years ago (1961).

The first VVER [water-moderated water-cooled power reactor]-440 of the Kozloduy AETs [Atomic Power Plant] was put into operation, and this year (1982) the fourth reactor of this type went into operation. Thus, the electric power capacity of the Kozloduy AETs has reached 1,760,000 kilowatts, with about 28 percent of the country's electric power of nuclear origin, produced with the participation of neutrons. Our energy program targets nuclear capacities of 5,760,000 kilowatts (electric power) in 1990, which is equal to almost all the country's electric power sources in 1975.

The discovery of the neutron marked the beginning of neutrons physics--the science of the properties of the neutron and its interactions with the nucleus and matter. The science has achieved a high level of development and significant results in studying nuclear structure and the nature of nuclear forces; in studying the fundamental properties of the neutron itself; in neutron-structure research, including research on biological objects; in studying the dynamics of condensed media, the magnetic properties of matter and phase transitions; in the physics of nuclear reactors and nuclear technology; in developing and applying the new methods of neutron physics in various fields of science and the national economy.

The methods of neutron spectroscopy are continuously being developed and used to study the excited compound states of atomic nuclei in the proximity of the binding energy of the neutron (7-10 MeV). The different quantum characteristics of these excited resonance states--width, magnetic moment, spin--are studied. With the methods of neutron spectroscopy exceptionally rich information has been obtained about nuclear levels, on the basis of which many fruitful ideas in nuclear theory have been developed.

The modern high-power pulsed neutron sources at the world nuclear centers of Dubna, Gatchina, Oak Ridge, Harwell, Los Alamos and Karlsruhe yield 10^{14}-10^{17} neutrons per pulse with a pulse length as small as fractions of a nanosecond

and have great path lengths of 200 to 1000 m. Significant progress has also been made in the use of high-speed detecting equipment, thus making it possible to study extremely small resonance state widths of the order of 10^{-7} eV.

Such a neutron-spectroscopic method has been used at the OIYaI [Joint Nuclear Research Institute] in Dubna to study the alpha decay of many complex highly-excited compound states of a number of nuclei. Our colleague N. Balabanov recently defended his doctoral dissertation in this field.

Another new and important area of modern neutron-physics experimentation is the work with polarized targets and polarized neutron beams. The polarization experiments are a very high-speed method of studying a number of very weak effects, for example the nonconservation of spatial parity and the effects of superfine interactions in the neutron resonances that make possible the measurement of the magnetic moments of the compound states, the variation in the root-mean-square nuclear radius during the capture of resonance neutrons etc. The measured energy level shifts, which are due to the weak interactions with intra-atomic magnetic and electrostatic fields, are of the order of 10^{-5}-10^{-6} eV, i.e. 4-5 orders less than the intrinsic neutron resonance width.

In collaboration with the Nuclear Problems Laboratory at the OIYaI in Dubna, a chamber method has been devised on the IRT-2000 reactor for studying rare nuclear reactions with neutrons, in which conversion electron-positron pairs are obtained in argon and hydrogen. These reactions have not hitherto been observed because of their very small cross-sections and because of the difficulties in creating a track detector capable of operating against the background of the reactor's intensive gamma field. In the energy spectrum of the pairs a grouping of the lines around 3 and 4 MeV is observed.

The neutron-induced fission process of heavy nuclei continues to be a subject of intensive research activity because of its exceptionally great applied and theoretical importance. For a number of years our colleagues at IYaIYaE [Institute for Nuclear Research and Nuclear Power Industry] in N. Yaneva's group have participated in joint experiments with the Neutron Physics Laboratory of OIYaI in Dubna studying the resonance parameters of fissionable nuclei. Joint experiments are now under way with the Kurchatov Atomic Energy Institute to measure the angular and energy distributions of fission fragments.

This same group has equipped a specialized channel on our IRT-2000 reactor in Sofia to obtain quasi-monoenergetic beams through the use of threshold (n, γ) reactions. The energy dependence of thorium-232, uranium-235 and uranium-238 in the 6- to 9-MeV energy range has been measured on this channel.

G. Tumbev's group has developed and installed on one of the IRT-2000"s horizontal channels an experimental device to study the gamma radiation accompanying the inelastic fast-neutron scattering process. In this reaction nuclear levels up to 5 MeV are excited, thus significantly broadening the field of gamma-spectroscopic investigations as compared with those of electron or positron decay.

Through appropriately selected experiment geometry, a method has been employed to measure the lifetime of the excited states by observing the attenuation of the Doppler shift in the energy of the gamma quanta emitted from the moving nuclei. The Doppler shift is measured simultaneously with two targets and in this respect the method used for this type of reaction is original.

The obtained lifetime results make it possible to determine a number of the nuclear parameters (transition probability, quadrupole moments, deformation parameters etc.) needed to construct a unified theory of nuclear structures.

Comparatively recently a method was discovered for obtaining ultracold neutrons (neutrons whose propagation velocity does not exceed the cutoff velocity for total internal reflection). The ultracold neutrons possess surprising properties. Thanks to their very low velocity (it is different for different reflectors, but does not exceed 7-10 m/sec) they are sensitive to gravitational forces and therefore propagate through multiple reflections by the walls of the vessel in which they are found, according to the laws of geometrical optics.

In recent years there have been a number of experiments to obtain, preserve and measure ultracold neutrons. A mechanical method of obtaining such neutrons through multiple reflection by moving flat neutron-reflecting mirrors was devised (for the first time in our country by N. T. Kashukeev). Later this method was successfully employed in the United States and on the high-flux reactor at the Franco-German institute in Grenoble (France). There a gravitational neutron spectrometer was developed in which the force of gravity spatially separates neutrons with different energies, and instrumentation was produced for measuring fundamental neutron constants like electric dipole moment and charge. The Leningrad Nuclear Physics Institute has obtained experimentally by means of ultracold neutrons the most precise result estimating the upper limit of the neutron's electric dipole moment ($1.6 \cdot 10^{-24}$ e.cm). Also ranking among the experiments on measurement of the neutron's electric charge is N. T. Kashukeev's suggestion of an experiment with ultracold neutron transition through multiple reflection in a strong electric field. The electric charge of the neutron is calculated from the resultant deflection of the neutron beam. The numerical estimates and the successful obtaining of an optical image of an ultracold neutron beam give reason for optimism for implementation of this Bulgarian suggestion for measurement of a fundamental neutron characteristic.

The fundamental properties of the neutron as an elementary particle of the class of baryons and hadrons are studied today by high-energy physics.

Experiments on elastic electron scattering by protons and neutrons yield data on the spatial distribution of the electric charge in these particles. Although the neutron is electrically neutral, its center and periphery prove to have an opposite electric charge. In addition, these data yield information on neutron size. It is of the same order as that of the proton--0.8 fermi.

According to the quark theory of hadron structure, the neutron consists of two d-quarks and one u-quark. The experiments at highest energies in recent years give conclusive evidence of this structure.

On the accelerator at Serpukhov there is a neutron beam with an average energy of 40 Gev. Investigations of the neutron beam by means of a specially designed proportional-chamber spectrometer have been conducted for several years by international collaboration of Dubna with the participation of Bulgarian physicists from P. Markov's group. The principal finding of these investigations shows that as the neutron beam interacts with the carbon target, there are generated the so-called charmed baryon and the lambda-c-plus particle, i.e. the process of the generation of charmed heavy quarks is observed. These quarks were observed experimentally for the first time in 1974.

Being an uncharged particle, the neutron has magnetic moment, with slow-neutron energy approximating the energy of atoms and intramolecular motions in solid bodies and fluids. Thanks to these properties that it possesses, the neutron is an ideal probe for studying the magnetic properties, structure and dynamics of condensed media. At all reactor centers methods of structural neutron-diffraction analysis are used extensively. Information about the atomic and magnetic structure of matter is obtained from the measured diffraction spectra and neutron-diffraction patterns.

Successful research work in this area is also being conducted on our reactor by the neutron-optics group (K. Krezhov, St. Neov et al.) with the help of a neutron diffractometer procured from Poland.

Some crystal-chemical and magnetic parameters of ferrites (of Bulgarian make) have been investigated, thus making possible the clarification of certain questions in the technology of their synthesis. The magnetic structure of the alloys of rare-earth elements that are employed to produce strong permanent magnets has been determined. Methods have also been developed on the basis of neutron scattering for studying amorphous substances which find ever greater application in optics, electronics and laser technology.

Neutron activation analysis finds extensive application in science and practice. In the fields of biology and environmental protection, investigations are being made of traces of As, Hg, Cu, Se, V and Zn in the soil, various plants and milk and of the content of heavy metals in fish due to marine pollution, as well as analyses of dust in the air and determinations of various elements in the water and certain toxic elements in various types of food. In biology and medicine determinations are being made of small amounts of various elements contained in blood, toxins, cells, the placenta of the human body; investigations are under way on various animals and on the permeation of leaves, roots and fruits by isotopes. Activation analysis is employed to determine very small quantities of different elements like gold, uranium, magnesium, copper etc. in rocks and minerals. The synthesis of complex compounds can be traced by this method, and a number of other investigations conducted in which very small samples have to be analyzed with great sensitivity.

An experimental center using the IRT-2000 reactor in Sofia has been equipped for purposes of activation analysis. A tube conveyor for short-lived isotopes has been constructed on one of the vertical channels of the reactor. D. Apostolov's group has devised methods for the determination of more than 30 elements in geological specimens. Work is under way to determine the trace-element

composition of organs and tissues of well and sick people. Methods have been devised to determine the industrial pollutants of water basins and bottoms and their impact on the living organisms inhabiting these.

We must note also another interesting and important practical application of neutrons in our country for determining the moisture content of soils. The neutron soil-moisture gauge devised by N. Buchvarov has won a high rating and recognition through CEMA.

The experimental atomic reactors are used as powerful neutron sources and for the production of various radioisotopes that find scientific and practical application.

The production program of our IRT-2000 reactor includes the making of tracer compounds, radiopharmaceuticals for diagnostic and therapeutic purposes, and shielded radioactive sources of about 40 radioisotopes with total activity of 30 to 40 curies per year that find the most diverse application.

Some highly-estimated achievements of the Radiochemical Laboratory at IYaIYaE, headed by M. I. Mikhaylov, merit mention:

--New general-purpose instrumentation and a modified method have been developed for obtaining monodisperse and polydisperse and radioactive colloidal preparations with gold-198 that find application in diagnostics and therapy for certain neoplasms. This development is protected by patent.

--In collaboration with the radiologists from the Oncological Institute in Sofia a new method and technology have been created for the production of radioactive bodies and two-pronged holders with radioisotopes of tantalum-182 and iridium-192 to be employed in intratissue Curie therapy for the treatment of malignant tumors. A patent has been issued for this development, too.

Worth mentioning besides are developments for the production of fluorine-18 with high specific activity, EDTA complexes with isotopes of chromium-51 and ytterbium-168, preparations labeled with iron-59 etc., which find application in radioisotopic diagnostics in our radiological clinics.

A great contribution also is the shielded radioactive sources of isotopes of cobalt-60 and selenium-75, produced by us for the needs of industry, to be built into various automatic systems for process control and for gamma-ray drill-hole logging during geological exploration for new deposits of ores and nonmetallic minerals.

Neutrons find a new application in biology where structural investigations are being made, for example, of proteins, membranes and protein complexes. Use is made of neutron scattering and the fact that neutron and deuterium have a comparatively great and different scattering factor. Neutron diffraction of the protein monocrystal can determine the location of the hydrogen atom which plays a dominant role in enzyme function. Besides localization of the hydrogen atoms, the carbon can be differentiated from the deuterium, and the nitrogen from the carbon and oxygen.

The difference between the scattering length of hydrogen and deuterium is of great significance for investigations if there is small-angle scattering by biological structures like membranes, viruses, muscles and protein complexes. The scattering angle (of the order of minutes) depends on the size of the scatterer. Scattering lengths are being obtained of the subfragments of the comparatively large chemical groups like proteins or lipids that are part of the cell of all tissues.

The rapid development of the nuclear power industry and the elaboration of new and improved reactor and thermonuclear systems are stimulating further research in neutron physics and the physics of nuclear reactors. Important and constant tasks in this area are to supply atomic technology and power engineering with precise nuclear data, to develop methods of evaluating and calculating neutron data, to develop methods of calculating neutron transfer and to devise precise measurement methods in this area.

Let us enumerate some of our research in this area which is intended not only to be of scientific service to the nuclear power industry in our country, but also to create scientific potential reserves for the development and introduction of new and promising sources of nuclear energy:

--Measurement with increased accuracy of the effective cross-sections of fuel and structural materials and fission products. A multisection scintillation detector, obtained from Kurchatov IAE [Atomic Energy Institute], and other instrumentation are used.

--Determination of neutron transfer constants for reactor moderators and shielding media by means of pulse methods.

--Precise measurements of the spectra of fast 14 MeV neutrons in materials important for thermonuclear hybrid reactor systems by means of a neutron generator.

--Development of numerical methods and programs of calculating neutron transfer and neutron-physical characteristics of reactor systems. These investigations are being conducted by T. Apostolov's group.

--Creation of effective measurement methods and automated instrumentation for intrareactor analysis and monitoring, conducted in T. Dragnev's group.

We can mention three groups of developments whose introduction is leading to the realization of considerable economic effect:

--Experimental methods and instrumentation for determination of the burnup fraction of nuclear fuel;

--Computer methods and programs for optimum nuclear refueling and for reliable and safe operation of atomic power plants;

--Methods of intrareactor monitoring of the hermeticity of the fuel element, of energy release in the active section, and of corrosion products in the coolant.

In these three groups of tasks, IYaIYaE in 1981 alone realized an acknowledged economic effect of over 6 million leva.

Within the limits of one report it is impossible to consider in detail all the fields of neutron use--the peaceful use of atomic energy. The peaceful vocations of neutrons are many. But at the very beginning of the atomic age, humanity was witness to a different, mad and criminal employment of neutrons --the chain nuclear explosion in atomic bombs. In our day the threats and blackmail of American diplomacy, which includes the neutron bomb in its arsenal of nuclear weapons, have not abated, either. Science is inseparable, however, from social progress, from the peaceful development of society. Neutron physics ceaselessly yields its scientific and applied results, its worthy contribution to the solution of the global problems of scientific and technical progress. The duty of scientists is to strive for the use of these results for the good of humanity.

6474
CSO: 2202/7

NEW COMPUTER CENTER COMMISSIONED

Sofia VECHERNI NOVINI in Bulgarian 11 Mar 83 p 1

[Article by Georgi Menelaev: "'Robotron' Is Designing"]

[Text] Todor Bozhinov, BCP Central Committee Politburo Member, first deputy chairman of the Council of Ministers and minister of metallurgy and mineral resources, inaugurated the new computer center at the Energoproekt NIPPIES [Scientific Research, Planning and Design Institute for Power Project Construction]. The ceremony was attended by Nikola Todoriev, minister of power industry, Ivan Filipov, first secretary of the Blagoev Rayon BCP Committee, economic managers and many guests.

The construction workers left this hall long ago, and so have the installation workers from the GDR, Czechoslovakia and our own Computer Equipment Plant. A light lit up the screens, interspaced by figures and text. The final preparations and tests were successful, and the new computer center of the Energoproekt NIPPIES was taken over by its true owners. Mathematicians, engineers, economists, operators.... It is difficult to determine their average age, but it appears to be under 30. To many of them work in the center is their first labor test. Will the young people be able to cope? The question was answered by Yotko Yotov, the center's chief:

"Every single member of this collective has been appointed on the basis of competition or proven qualities elsewhere. These are highly skilled specialists, sharing the desire to advance and the ambition to march in step with the new -- the people who will be operating the new equipment. Adding to this a great deal of youthful zeal and enthusiasm, future success seems indeed guaranteed."

A great deal of trust has been voted to the youthful collective. The Robotron-ES-1055 is one of the latest third-generation computers. It is the work of specialists from the GDR, USSR, Poland, Czechoslovakia and Bulgaria. It has a huge operational memory of 2,048 kilobytes. A widespread network of terminals makes the full use of this significant potential possible. The machine can perform 450,000 operations per second. Its curve plotter has a four-color design capacity. It will plot automatically high-quality designs and diagrams.

Engineer Petur Mishev, candidate of technical sciences and director in charge of automation and control of design, is perhaps the person most excited in the final hours preceding the start-up of the computer center. During the 11

months it took to build the center, he supervised closely all construction and installation work and is familiar with literally every part of the complex equipment. That is probably why he remains excited desdite his confidence in success:

"The computer center will enable us to apply a system for automating design work. Its advantages are comprehensive. Above all, it will be possible to provide a number of alternatives to any given project and to choose the optimal one. In addition to everything else this will considerably upgrade work quality. The installation of a design automation system will make it possible for the efforts of many specialists to be directed into other more creative activities. Actually, the computer center will enable us to intensify design processes in the spirit of the resolutions of the 12th party congress."

All we can add to the statement of Engineer Mishev is that savings for the balance of the five-year plan alone, resulting from the installation and start-up of the center, will total 25 million leva. Additional foreign currency in excess of 2 million leva will be earned from projects carried out abroad. The expected savings in capital investments from the "Design of Power Industry Projects" alone will reach 7 million leva by the end of 1990, and operational expenditures for projects will be reduced by 18 million leva.

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CSO: 2202/9

BRIEFS

CZECHOSLOVAK GEOLOGICAL SERVICE--Geological service in the CSSR is incorporated in two national organizations [Czech Geological Bureau and Slovak Geological Bureau] which employ about 15,000 specialists. The volume of Czechoslovak geological effort has increased 4-fold in the past 25 years, reaching an annual expenditure of Kcs 2.3 billion. Czechoslovak geologists have participated in geological work in all of the world continents except Australia. [Prague LIDOVA DEMOKRACIE in Czech 16 Apr 83 p 3]

CSO: 2402/41

DOMESTICALLY MADE PERSONAL COMPUTER MO8X IN INITIAL PRODUCTION

Budapest NEPSZABADSAG in Hungarian 6, 7, 8 Apr 83

[Series by Gabor Pal Peto: "Do-It-Yourself Computer Technology"]

[6 Apr 83 p 7]

[Text] Manufacture and sale of professional as opposed to hobby personal computers has begun in Hungary also. Their price--as compared with a price of several million forints for the smallest computers earlier--is small, 500-580 thousand forints with display and printer, so not only can small plants use them but an enterprise can get them even for its plant units.

Domestic development and initial manufacture of professional personal computers took place in just a few months (more about this later). For example, the Computer Technology Coordination Institute [SZKI] began to deal with the idea in early spring 1982 and by the end of 1982 had delivered machines to the first customers.

1. How They Are Used

The Survey and Soil Testing Enterprise [FTV] does many types of work--engineering geology, soil mechanics, foundation, industrial geodesy, corrosion protection and environmental protection testing, planning and control. It follows from this that it has a large number of customers and contracts. Keeping records on these activities is difficult, so it is obvious that they should use a computer.

"Oh, please, they are again using a computer for some administrative task!" Certainly many readers will dismiss this with exasperation. Well, keeping records is not such a minor thing that it would be wrong to get a computer involved in it, but they are far from using the computer only for this. Dr Andras Salamin, engineer and mathematician and chief of the small (four members, counting him) computer terchnology section of the FTV, has this to say:

"When we got this professional personal computer from SZKI we thought that the younger engineers, those around 30 years old, let us say, who had already studied something about it at the university, would in interested in the work that could be done with it and that we would do the computer work for our middle-aged colleagues. Then we gave a demonstration and advertised a computer operator course...and we ourselves were scared of what happened. Sixty people signed up, including the middle-aged and even the older colleagues! We could not train all of them at once, because the essential thing is to have them sit down at the machine and press the keys with their own hands."

For Engineering Work

While the expert said all this, I looked at the machine. It seems simple, with virtually nothing to say about it. A picture screen glowing green sits on a small table with a keyboard, like that of a typewriter, in front of it. Under the table--where the drawers of a desk would be--are two slots with writing on them, a little pamphlet beside the machine and nothing more. The room is an ordinary room; it is true that there is the hum of an air conditioner, but only because the room has no windows. The designation on the machine is M08X, which is pronounced "M zero eight X" (M for micro-computer, 08 because it works with 8-bit "words" and X to distinguish it from other models).

"The fact that the experts can operate the computer themselves means a basic change," Dr Andras Salamin emphasized. "Before, many did not even want to hear about computers because it meant they had to hand their data to a white-coated operator in an air-conditioned room (Entry Forbidden!), a computer operator who understood nothing of their work, and they presumed he was not even interested. Then after a while they would get back the results, and if something did not tally they could begin from the beginning.

"And now? The course is not over yet and some are working their own programs. Some are using programs developed by our small group and, of course, others are using programs bought from the SZKI. But they are working with the programs themselves, and this makes for a great feeling of accomplishment. We are talking about engineering work, not recordkeeping! For example, experts from our enterprise are doing geodetic work for construction of the Paks nuclear power plant and they can do the processing and evalution of the measurement data here. We developed a cylinder-jacket-fitting program. This is a little awkward to say, but the essential thing is that the engineer sits down at the machine, enters the data, calls up the appropriate program on the basis of keywords written in this little pamphlet of a few pages and begins the work--in the conversational mode. The machine gives the results immediately and they can be corrected, tested or changed. Many are demanding already that we buy at least one more such machine."

It Will Not Accept Errors

"In addition, this machine is an accessory to a large machine, a so-called intelligent terminal. Contact can be made with it to the large computer of

the SZKI on an ordinary telephone line. (Actually, ensuring a telephone connection is the most difficult problem.) We have calculated that on a single job, for example, which prior to buying the M08X we would have done on a medium-size computer, including correction of errors, we could have saved 300,000 forints."

Operating the machine is extraordinarily simple, and the computer technicians at the FTV have developed an entire series of "program morsels" which the engineers can put together to do a bunch of jobs more easily. The machine writes out the instruction on the screen--naturally in Hungarian--or puts a question to the person working with it. It says that if you want this, then press, for example, the keys NW, or if you want this, then press MY. One cannot make a mistake on it, because considering that it will be used by those who are not computer technicians, the machine has been "taught" that if faulty data is given it, for example a letter in a group of numbers, then it will not go on but will write out, as a warning, the faulty line.

"This is a personal computer," Dr Andras Salamin said, "although a person cannot use it at home. But this is not the essential thing. What is essential is the personal contact with the machine. This was a very great change, and the machine offers a great deal because its data storage area, its memory, can be increased virtually without limit. All you have to do is put more floppy disks there, in the two slots."

The "floppy disk" looks like a phonograph record--thin, round, black, in a special paper case--but it is the size of a small record. There are 256,000 bytes (which is 8 bits) of information on such a disk. (This is sufficient to store about 60,000 seven-digit numbers.)

Buses, Drivers, Conductors

The Volan Trust Elektronika (computer center) is also trying out its first M08X now. But this does not mean that they do not know what they could or want to use it for--although they have not yet discovered all the possibilities.

"In the summer of last year," said mathematician Aniko Halay, chief of the small computer organization department, "when we already knew we were getting such a machine, I made a tour of the Volan enterprises and, studying the work, estimated how many things we could use this simple and undemanding machine for. On the basis of this study I am informed that the Volan Trust is planning to buy several dozen M08X computers."

Naturally a personal computer could be used outstandingly in the warehouses of the units of the 25 Volan enterprises--keeping records on all the material and parts, asking for them and constantly checking stockpiles automatically (when one must reorder what item)--and all this there, on the spot. Because the machine could be set up in the warehouse, it does not require an air-conditioned room or an operator; the warehouse man can handle it himself. But--sticking more or less with administration--the machine will be good for keeping records on contracts and investments as well as out-time.

The machine can be used well to work out variants to facilitate "detailing," optimal assignment of men and vehicles, or to work out which worker should do what task, when, and on which vehicle. The calculations of drivers, conductors and cashiers can be done by computer also, thus putting an end to the gigantic amount of handwork, which consumes an unimaginable amount of paper.

"Then we can work out fee tables," Aniko Halay continued. "A triangular diagram has been worked out for every route of every unit. On one side is the length of the route and on the other the fee figures. If one stop changes, it has to be recalculated and rewritten--very inconvenient work. Now the computer can take it over."

The processing of passenger survey data can be done on the machine too. The center will not do this but the units themselves will, so the calculations will be done there also.

Decentralization

"This will lead to decentralization, which is always important and useful. The chief goal in using microcomputers is to make information truly operational by bringing the tool to the user. We propose carrying out tasks which could not be carried out economically with a large, central computer park or where data collection would cost a great deal. Our plans include primarily the development of systems which always satisfy unique enterprise (customer) needs; their purpose will be to aid management."

Our interview had to be interrupted because some people had come in from a provincial Volan enterprise to get acquainted with the new machine and its possibilities. In farewell Aniko Halay said: "Such a spread of the computer network means if questions are correctly formulated--and this is a matter for the economists--leaders will be able to get processed information which will make the situation easier to review and make the decision possibilities and variants clearer. The economic consequences of all this could be very great --and naturally advantageous for the traveling public also. But this does not depend on the computers but on the people making the decisions, people whom the machines will relieve of time-consuming tasks."

[7 Apr 83 p 6]

[Text] 2. How They Might Be Used

When the first computers began to be used, by far the greatest part of the price, 90 percent, went to produce or purchase the mechanical equipment, hardly 10 percent went for programs. Today the situation has been turned around; it is the program which gives the true value or utility of the computer and producing the program is intellectual work. (This is fortunate, because in this way Hungarian experts cannot only "play ball" in international competition and cooperation but can make some income from the programs developed by them.)

Today the manufacturing firms deliver with every computer certain basic programs and will work out user programs on order; indeed, there are enterprises which deal with developing these exclusively. Last but not least every user himself also develops or adapts for his own purposes smaller or larger programs or at least parts (as we could see in our previous article in the case of the Survey and Soil Testing Enterprise).

The Computer Technology Coordination Institute, which created the M08X professional personal computers (on the basis of a design of the automation faculty of Budapest Technical University) and--for the time being--manufactures them, has also developed a line of programs which it wants to sell. As of today they do not wait until the customer knocks on the door with his requirements but rather they develop programs in advance, which then can be developed further, combined and adapted.

So a number of programs are ready for the M08X and more are being prepared. We will describe some of these, not as an advertisement but rather as a way to give a feeling for this work.

Self-testing

Text processing. Letters and descriptions of a few pages are frequently prepared with almost identical text. The computer programs these with this program, but one can make changes in the several copies too.

It is a program to recall textual information stored in the memory of the machine.

Inventory control, according to quantity and accounting price. The machine also keeps track of changes in inventory. It shows the momentary status, whether sold or acquired.

Order records. A machine controlled by this program keeps track of customer orders or orders filled.

It is also possible to keep records on materials, just as the bearer of the expense records materials issues and follows the accounting price. If the quantity of material falls below a certain level, it warns of the need to resupply.

The machine can also keep records on parts and also of drawing numbers, independently or connected to the parts records.

Following and keeping records on investments is an important and no small task. With an SZKI program the M08X keeps records of jobs approved in the basic investment document, if you like, by source. It follows the phases of realization, it prepares periodic reports and calculations and prints them out, and on completion it prepares final figures and publishes the historical data.

Sales analysis. Turnover data are analyzed from a number of viewpoints, for example, turnover taxes and statistical distribution; this indicates the "sensitive" points of marketing policy. This is a worldwide method of modern leadership.

General table program. The stored data is displayed in eight formats in a table with three total ranks.

Data checking program. Erroneous data put into the computer can cause great confusion, so they have prepared a program which checks the data put in; those it finds without error are written out so they can be put on a floppy disk and incorrect data are printed out, naming the type of error. If the error was caused by miskeying, an "error" message appears on the screen and it can be corrected immediately in the conversational mode.

Wage figures, preparation of the payroll, wage distribution and the printing of statements, print-out of statistics on the wages and wage components earned, monthly deductions, premiums and other payments.

There is a system which can be connected to time-wage calculations or run without them, which collects for each individual the time worked and the reason for various absences. It can also handle "sliding" hours carried over from one month to the next. The data can be called up on the screen or one can get printed lists by worker or group or for all enterprise personnel.

A materials management computer program. This can be connected to costs management but can be used independently also for flexible reordering, management and analysis of idle inventories and turn-around time or for use analysis.

Through a further development of fixed assets recordkeeping it is also possible to have computerized fixed assets management. This is a great aid to enterprise management; it can be widely used for forecasts based on an analysis of past data, for capacity analysis data and for economic analyses.

It Also Makes Recommendations

Enterprise results can be reviewed easily at any time with a program which calls up stored data on the screen showing the most important enterprise indexes and gross balances or prints out the balances of the debit-credit columns of the chief accounts.

Cost management program. Various types of cost management information can be called up on the screen or printed out by cost type and divided up by cost bearer by building in economic analysis procedures. Cots development forecasts can be prepared also.

With the aid of a production cost analysis program the machine does production cost analysis on the basis of cost data by preparing production cost development forecasts covering the entire project structure. On the

basis of calculations of economy it make recommendations (!) for changing products or changing acquisition source; on the basis of earnings forecasts it prepares market policy forecasts.

Providing data for higher authorities is a frequent and large job; a program has been prepared for the M08X which does this in regard to, for example, turnover taxes and statistics. Separate programs were worked out at SZKI for industrial and commercial enterprises.

SZKI also developed a series of programs for engineering and technical measurement and calculation tasks, for example, for panel calculations--such as calculations of the stress and movement of wall beams of flexible material and for calculations of the movement and stress of sheet materials made of flexible material (such as reinforced concrete), the movement of the junctions of planar bar structures consisting of straight axis bars in an optional network, the stress of rods, etc. It would take a long time just to list the things that can be measured and probably few would be able to evaluate their significance. So in conclusion let us introduce briefly just two interesting programs.

Fodder and Travel

Economical feeding of animals is very important in agricuture, in keeping and especially in breeding animals. Producing the optimal fodder mix is an important task for this. There is a program for the M08X; keeping in mind the biological needs of the animals, it provides the recipe for the fodder mix which can be produced at the least cost. It can do this calculation for both hogs and poultry.

Institutions which require a lot of foreign travel need a fast, easily handled information system. At SZKI itself--where they feel this need due to the significant export of programs to the capitalist market--they prepared, as a subsystem for the program called the central information system, a "computer information service for foreign travel." This provides the leaders with information needed to select colleagues with the requisite subject or language knowledge, the status of the travel documents of the person selected, the foreign trips which have been made and the destinations and lengths of visits. This is also an important aid for the colleagues making the trip because it keeps a record of when his passport or visa expires, data connected with the passport, the time limits for travel documents and travel accounts and the foreign exchange allotment; it also prepares statistics on official trips made, grouping the trips by, for example, purpose, number, costs bearer, destination, purpose and institutional section.

All this, naturally, only shows the status at the moment; the preparation, development and modernization of the program go on continually in accordance with the needs and views of modern computer or information technology.

[Text] 3. How They Are Made

How did the computer industry and computer development get to personal computers, for in the beginning the industry made gigantic machines and then connected these in networks? Why is it that the development of small machines has accelerated in such a visible way? And, what may be an especially interesting question, how does Hungary, which could not compete with the technically most-developed countries in more prosperous years as a result of the restricted nature of its material assets, now keep pace with the new trends of computer technology in this area, if only in a rather narrow part of it? The appearance of the M08X professional personal computers of the Computer Technology Cooordination Institute seems to indicate that it has.

I turned to Dr Zsolt Naray, director of SZKI, for an answer to clarify this complex group of quesitons.

Two Trends

"Actually one can see two trends in computer technology," Dr Naray said. "On the one hand there are the very high performance machines which handle large data banks; the users can access these via terminals. But there are a number of tasks which appear at the workplace and are best solved there. In this case the user must have personal contact with the computer without go-betweens. The machine works with programs which are prepared by its developer but which are made to order. Production of machines of the latter type was made possible by the fact that the parts used in computer technology have become ever more complex and ever cheaper. So from the technical and material viewpoint it is possible for a machine which would have filled half a room 10 years ago to fit on a desk and to cost several hundred thousand forints."

"But is there a user need which makes this necessary and possible?"

"The needs of a private person, the so-clled consumer, are directed primarily toward something like schoolwork, games, mechanical chess, recordkeeping of family finances and tasks or control automats."

I should have asked, is there a need for it in production, in services, and the answer was, there is. "For example, there is certainly a need in the engineering sciences to do certain jobs, to process scientific research measurement data, to process commercial and financial data and to carry out the recordkeeping tasks connected with the movement of goods. For example, I myself use an office computer as an aid in carrying out my work, in maintaining the necessary literary material (where and when articles and books appeared, etc.) in accessible form; at the same time, a short extract of their contents can be found in the disk storage of the machine and can be displayed on the machine. In addition, I believe that I will never be able to exploit the full capacity of this machine, because it could store data

and extracts from 50,000-60,000 articles! But other researchers might need to store this much data; a toxicologist, for example, could store medicine incompatibility data for a physician and so forth."

A Working Tool

"So the technical and material possibility exists and there is a need for the computer to emerge from the air-conditioned rooms where operators run them. How do you make it possible for lay people to operate them?"

"If we are to put this working tool (because that is what it is, a working tool!) in the hnads of a number of people pursuing various professions, then it must be versatile and it must be simple, adaptable and self-correcting; the software must be accessible to lay people. In addition, if someone wants to develop such a machine and manufacture and sell it in as large numbers as possible, he must see to it that the users themselves develop in the course of use; in the beginning hardly any user can see all the uses he will have for a personal computer. So one must see immediately in what direction it is necessary to develop the machine further, increase its capacity and at the same time make the more developed machine compatible with the earlier one. At a certain point the expanding computer systems being built in this way may meet up with large computers and large networks and become organized into a uniform system. So the bridge must be built from both sides at once.

"But the matter is even more complex, because the computer must be simple. Development also includes the organization of instruction and preparation of the documentation accompanying the machines--this is very important, in the interest of future development--and there are many other tasks."

"This, as you are in the custom of saying, is the ´philosophy´ of a personal computer. But how did you come to the idea that personal computers were needed in Hungary too and especially that it was possible for you to make them?"

"The initial developmental philosophy for computers was that we had many large national enterprises, so we would need large computers, and these would be the inspiration for development. This is true, but there are drawbacks too. These machines were always a little larger than they had to be, at least at first. It is not necessary to use larger machines at the other end of the bridge mentioned, and the initial investments are much smaller. It is not necessary to build a computer center, and one does not need an air-conditioned room, false ceilings and false floors, personnel of such training that they cannot be fully used in the beginning.

"In addition, from the domestic viewpoint, a program of the OMFB [National Technical Development Committee] dealing with microcomputers called attention to the importance of this trend. This produced a favorable reaction and appropriate steps from a number of involved Hungarian enterprises--Videoton, MOM [Hungarian Optical Works], the Telephone Factory, the Signal Technology Cooperative, etc. Added to all this is the present investment situation,

the restricted nature of which need not be expounded. So we came to the decision to manufacture a domestic professional personal computer."

In Months

"When did this happen?"

"You will not believe it, but in 1982; yes, in April of last year. We had hardly started to develop the machine when we learned that they had developed a system suitable for this purpose in the automation faculty of the Budapest Technical University. We immediately abandoned the development of our own and bought this system, which only had to be developed a little bit further to fit into a system of workplace personal computers consisting of several members, as we had imagined it, and we began to develop the other devices of this system simultaneously, in parallel, not waiting on the development of the computer.

"Even so, we developed here only what could not be bought elsewhere, because we got the display and keyboard from Orion, the disks (floppy disks) from the Hungarian Optical Works, the disk drives from the Laboratory Instrument Industry Works and other parts too. At the same time we began to develop the user programs.

"We demonstrated the first working machine in May 1982 at the Budapest International Fair. We organized manufacture of this device in just 3 more months. SZKI undertook this itself, at least for the time being. To a large extent it is made by a few people equipped with automated final calibration tools. We sold 49 of these machines by the beginning of February, we reached a total of 100 in the first days of March and we count on selling 400 by the end of the year.

"But working with the so-called parallel method mentioned above, we are working simultaneously on the development of three other personal computer models, because one can stay on the market today only with "families." The coming models will include a 16-bit one too. You will be able to see it at the spring Budapest International Fair. It is too early to talk about the others, but we would like to move on with this method and at this tempo. In any case, the income of our institute, per worker, is 1.2 million forints per year from services and development and from the creative work embodied in machines and programs."

So this is the story of a Hungarian professional personal computer which is working and can be seen in more and more places of work every day. And the nicest thing in this nice, useful creative work, which is profitable for all, is that it has not come to an end, has not stopped, but constantly keeps developing further.

8984
CSO: 2502/33

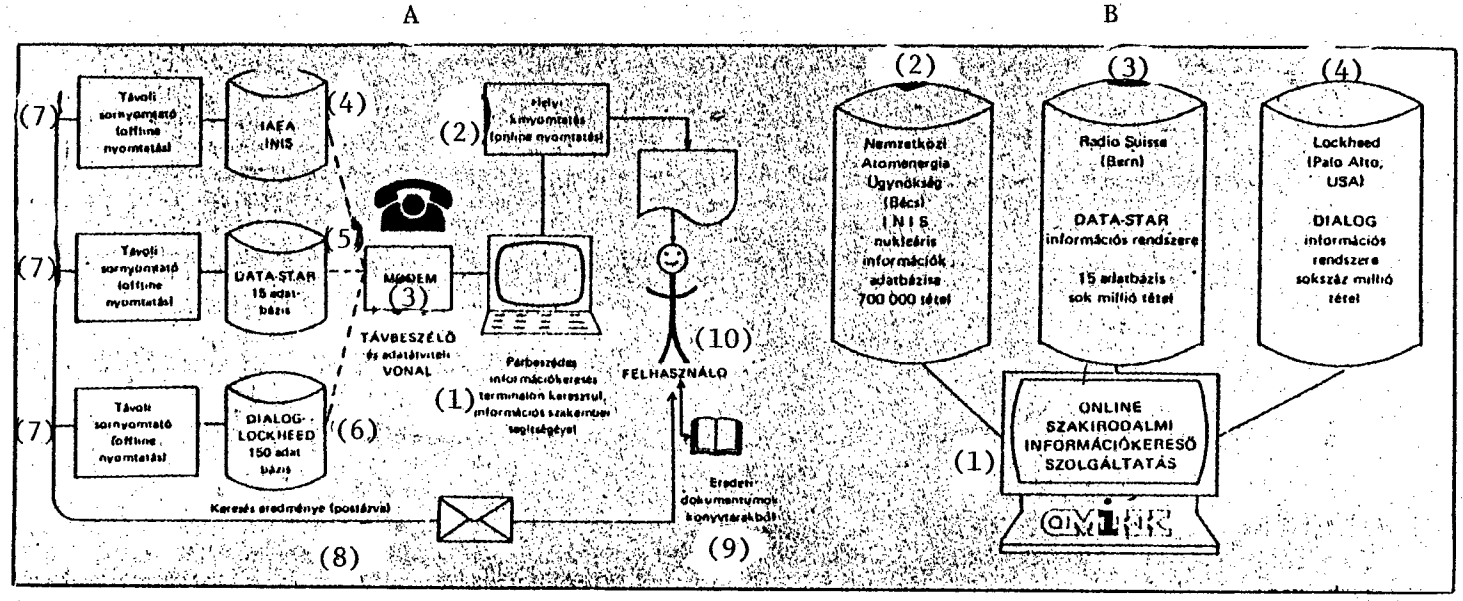
HUNGARIAN ON-LINE TERMINAL LINKED TO BERN DATA STAR

Budapest OTLET in Hungarian 10 Mar 83 p 4

[Summary] OMIKK (National Technical Information Center and Library, Orszabos Muszaki Informacio Kozpont es Konyvtar) has recently canceled subscriptions to 175 less productive Western technical publications out of a total of 2,600 received, because of shortage of funds. However, beginning in mid-1982 it set up an on-line information locating service. Requests may be addressed to the operator of an on-line terminal who passes them on in English to the Data Star computer center in Bern, Switzerland. The Swiss computer system stores all scientific and technical information published to date. The cost of using a data base for 1 hour ranges between $60-70. The charge for 100 units of information located is $25 while phone rates are 25 forints per minute. Tracking down a desired theme can cost an enterprise 5,000-8,000 forints part of which must be paid in dollars through Technoinform. From September through December 1982, Hungary was able to obtain data on 100 themes via its terminal.

Interest in certain publications available in the OMIKK library has increased to such an extent that many of them are microfilmed on arrival and their table of contents disseminated. Requesters received 600,000--one million pages of photostats annually.

To make information accessible to users lacking foreign language capability, OMIKK employs 4,000 contract translators. Translation offices have been set up at Debrecen at Lajos Kossuth University, Veszprem at the Chemical Industry University, Miskolc at the technical library of the Heavy Industry University as well as at various other provincial cities. Speeding up translation is an urgent task because sometimes an entire year elapses before a translation reaches a requester.



Key: A (1) Information search in dialog mode via terminal with assistance of special operator
(2) Local printout (on-line printing)
(3) MODEM: telephone and data transfer line
(4) IAEA: International Atomic Energy Agency, INIS
(5) DATA-STAR: 15 data base
(6) DIALOG, LOCKHEED: 150 data base
(7) Teleprinter (off-line printout)
(8) Search results in hard copy via mail
(9) Original documents from libraries
(10) Consumer

B (1) Terminal: on-line, technical information search service of OMIKK National Technical Information Center and Library) in Budapest
(2) International Atomic Energy Agency (Vienna) INIS data base for nuclear information: 700,000 items
(3) Swiss radio (Bern) DATA-STAR information system 15 data bases, many millions of items
(4) Lockheed (Palo Alto, USA) DIALOG information system, many hundred million items

BRIEFS

ROBOT PRODUCTION--At present, 20-30 robots are in operation in Hungary excluding manipulators. Their operation is not an unqualified success. For example, we purchased the license for a two-armed robot, the PRC-1 in 1980 at a cost 65,000 rubles. The robot services cylindrical rolls, presses and deep-drawing machines. The Gyongyos factory of United Incandescent made six such robots two of which it was unable to sell despite the fact that costs would be realized in one-and-a-half--two years. Although robots are the key to flexible production, the enterprises are not receptive to them according to Dr Endre Horvath Sr., scientific member of the System Organizing Enterprise (System Szervezo Vallalat). The Industrial Information Center is currently setting up a course on robot engineering. Up to now, a total of about 100 persons has knowledge of this field, most of it acquired as a hobby. According to CEMA distribution of labor, the USSR, Bulgaria and the GDR are to make robots. The USSR plans to have 125,000 by 1985; the GDR, 45,000. This may trigger some action in Hungary. [Text] [Budapest ESTI HIRLAP in Hungarian 14 Mar 83 p 3]

CSO: 2502/34

MILITARY INSTITUTES DEVELOP NEW ALLOYS, GREASELESS CORROSION INHIBITORS

Warsaw RZECZPOSPOLITA in Polish 5-6 Feb 83 p4

[Interview with Col (Prof, Dr Hab, Eng) Janusz Janecki, commander of the Institute for Tank and Automotive Equipment, by Bronislaw Dostatni: "Corrosion Control and new Technology: Army Science for the Economy". Time and place not specified]

> [Text] Army scientific research institutes perform much useful work for the national economy, too. One of those institutes having considerable accomplishments in that area is the Institute for Tank and Automotive Equipment. RZECZPOSPOLITA journalist Bronislaw Dostatni, discusses that topic with the commander, Col Janusz Janecki.

[Question] What do you consider the most important task of the institute?

[Answer] I find enormous savings in modern corrosion control methods. We have been working on this problem for several years already and if our suggestions were to be universally applied, in the broad sense of the word, savings of millions of zlotys would be achieved over a period of a year. The average citizen does not understand what sort of losses the national economy bears, if only because of corroding of an enormous volume of spare parts filling warehouses and which are, as a rule, inadequately or poorly maintained.

Our institute took up these problems several years ago. We were compelled to this by the conditions of operation, service and storage of military equipment in the field, regardless of atmospheric conditions. For the results of our research in the area of new equipment maintenance technology, we received the State Award. Among other things, we have developed greaseless corrosion inhibitors that eliminate the use of grease in equipment maintenance. We have repeatedly extended the storage life of spare parts without the need for secondary maintenance. Our inhibitors are produced in the form of powders dissolved in petroleum. Instead of grease, the part is covered with a very thin film of our inhibitor and does not have to be cleaned before use, i.e., before installation in a machine.

Introduction of these experimental results to the economy is proceeding with great difficulty. However, one must assume that at the present time, when every enterprise is obligated to counting every penny, many of them will come over to our methods, especially in the agricultural and construction machinery industry.

In places where our method has been used, the effects are visible. According to modest calculations, millions of zlotys have been saved. More important, however, is the problem of extending the operating life of spare parts or finished products awaiting operation.

[Question] Is progress in the technology of new alloys important for the economy?

[Answer] Our other interesting scientific research solution is just the development of a new bearing alloy based on zinc and aluminum, which will successfully replace copper-based alloys. In some cases, the new alloy lasts twice as long.

We have already had concrete results. We tested the new alloy is a thousand Ursus tractors. The BIMET Bearing Factory in Gdansk has introduced bushings made of this alloy. We estimate, according to our present figures, that the cost of the new product, together with the suspension, may not exceed 50-60 percent of the costs up to now.

New alloys and interchangeable materials (alternate steels) are contributing to the general modernization of diesel engines being produced for the needs of both the army and the economy. In connection with this, we made an application contract with the M Nowotko Mechanical Works. The economic effects achieved, only in the first year of modernized production, amount to about 200 million zlotys.

[Question] Is the development of projects for substituting foreign products and materials presently important?

[Answer] Work being done in this regard on friction materials. Several years ago we developed a new friction material for use in brake shoes for the Fiat 125. The materials were patented and announced for introduction. Unfortunately, a license from the "Texstar" company was purchased. The license purchase was motivated by the fact that although our material is excellent, we are not able to provide machines and assembly lines to the producer. Our idea thus became used only within the institute.

It's a good thing though that this happened, because not only did we have good shoes in cars in use, but at the same time, we were able to do more testing.

The present economic situation brought us help in this regard. When there was no money for buying "Textar" components, we were remembered. At this time, work in adapting production to the use of our patent is continuing,

although with difficulty. Our shoes last 40,000 kilometers, and are thus generally as good as "Textar" shoes, but presently produced domestic brake shoes have to be changed after 10,000 km. Of course, this is the result of components poorly chosen by the domestic producer. After all, our proposal could have been considered years ago. The Polish State Railways also intended to buy a license in past years, but our information was shared with them, as they found out about our work. We have already finished certification and semioperating tests. This has great importance, particularly for the railways.

12261
CSO: 2602/12

FIRST LASER-CONTROLLED, MULTIFUNCTIONAL ELECTRIC ROBOT

Bucharest INFORMATIA BUCURESTIULUI in Romanian 21 Feb 83 p 3

/Interview with Engineer Vladimir Doicaru PhD, chief of the "Fellas" collective, by Leonard Gavriliu, date and place not specified/

/Text/ In one of the laboratory workshops at the enterprise of electric calculators, we spy several electric motors on a workbench. This is unusual for this enterprise where there are normally integrated circuit boards, the peripheral components for computers and control instruments. We are interested in the purpose of these motors in these surroundings geared specifically to the information industry. We receive an explanation from Engineer Vladimir Doicaru PhD, chief of the "Fellas" group (Felix plus laser), a team of young engineers and researchers in whose visitors' book is written "For us, there is no impossible."

The motors you see--he told us--are components of the first multifunctional Romanian electric motor "Robopas 0101" which was planned and produced in cooperation with a team from the electronics department at the polytechnical school in Cluj-Napoca, coordinated by Professor Engineer Arpad Kelemen PhD. The principal characteristics of this complex machine lie in its operation with "step-by-step" electric motors, controlled by a laser beam transmitted through optical fibers--a true cymbiosis of electrical machines, computer technology and optical electronics. It is a type of robot of the newest generation, which, however, does not require a position sensor, thus eliminating the importation of this item. Furthermore, except for the microprocessors and the afferent circuitry, all the components of the robot are the fruits of Romanian industry.

/Question/ Other special characterisitcs?

/Answer/ Eight levels of action, an operational range in which the robot is able to move items weighing up to 20 kg, with an accuracy of up to .005 degrees--this is capable of serving a number of machine tools. One of its greatest advantages--in addition to the "step-by-step" motors which give it a high degree of precision--is its option of laser control through optical fibers, thanks to which the equipment is practically immune from chemical, industrial and electrical disturbances, vibrations, etc. Thus it has unrestricted applications in the aluminum industry, metal working, the chemical

and even electronics industries, given that it can perform the most precise operations, such as mounting components on integrated circuit boards.

/Question/ How long have you been working with robotics?

/Answer/ From the moment when I had the idea of interconnecting industrial robots with lasers through optical fibers, an idea which occurred to me while I was still working on my doctorate. In this regard, I would say that the determining factor for me was discussions I had with Profession, Doctor, Docent, Engineer Mihai Draganescu, director general of the Industrial Central for Management and Informatics, whose creative direction I benefited from during the work on my doctoral thesis.

/Question/ What "wind" pushed you toward Cluj-Napoca?

/Answer/ I would say that the favorable wind of integration of learning with research and production blew me there. In the specialized literature, I learned that at Cluj Polytechnic they were carrying out most promising research toward building and using "step-by-step" electric motors, while our enterprise was interested in using these in a system of interconnection by laser with the "Felix" computer which we manufacture. Hence, it came to pass that in 1976 I went to Cluj-Napoca to take a closer look at the work that interested us. In this way we laid the groundwork for very fruitful cooperation and, after completing the project to which I referred, I took up the idea of a multi-functional electric robot together with Professor Kelemen. Thus "Robopas 0101" was born, the prototype for which was universally well-received at an exhibition of the National Council for Science and Technology in 1982. Number zero of the robot is scheduled to be completed this year and it will be placed into operation in a heavy machinery factory for the time being. Our enterprise boasts of setting up an industrial central for the robot, creating its laser-controlled command unit using optical fibers, as well as of writing the computer program in accordance with its current destination. I must point out that Engineers Mihai Oltu, Adrian Dorobantu, Gabriel Stanciu and Andrei Kossa, all from our collective, made an essential contribution to all of this.

/Question/ What other projects do you have in the area of robotronics?

/Answer/ Among other things, we are working on creating a highly flexible automated technological operational series in which the robot is connected to different data sources. This work will enable a technological line to be fully serviced by interconnected industrial "Robopas" robots. These would make use of a telecontrol system from the "Fellas" family and could execute a very wide range of operations; the servicing of machine tools, welding, painting and so on. In order to perfect the necessary programs for these "multifunctional" lines, we intend to turn to the specialists in the computer department of the faculty of automation, whose head is Professor Engineer Adrian Petrescu PhD. For many years, our enterprise has worked very well with him in other areas.

12280
CSO: 2702/10

DOMESTIC MICROPROCESSORS BEING USED IN ELEVATORS

Titograd POBJEDA in Serbo-Croatian 3 Mar 83 p 4

/Article by J. Stamatovic: "Intelligent Elevators"/

/Text/ This article tells how "domestic intelligence" is being used at the David Pajic factory, our largest and oldest manufacturer of elevators. Collaborating with the Mihailo Pupin Institute, complex microprocessor technology has been mastered. The microprocessor controller errorlessly governs the new elevators. Getting stuck in an elevator, and seeing the sign "Elevator Out of Order" are now things of the past. Now comes the struggle for market share.

"Sensors," "diodes," "digital seven-place readout of the cabin's position," "memory," "exchange of information and commands between the microprocessor controller and the cabin and second floor parts of the elevator system." These expressions that I heard recently in March are part of the "dictionary" of the employees at the David Pajic factory, Daki, in Belgrade, our oldest and largest manufacturer of elevators. But one should not be too surprised. Two years ago they decided here to give the old, classic elevators a well-deserved retirement. It was said and done. They sat down with specialists from the Mihailo Pupin Institute and 2 years later a new family of elevators was born. The new elevators will be controlled by an "intelligent" microprocessor controller, a truly marvelous technology. The new member of the family of elevators at David Pajic was received with open arms. During the 6-month test period the controller broke down only once.

The work has paid off. Once more it has been demonstrated that when science and business work together, they work best. And what is more, they have shown at the David Pajic factory that we have answers to some quite difficult problems of microprocessor technology. After all, is it not generally known that information concerning these types of problems, which is in the hands of many eminent manufacturers of elevators throughout the world, is usually found only in their design offices or in safes where the most secret business information is kept?

But, judging by what I heard, it will not end here. According to Dr Dragoljub Milicevic and Danil Popobiv from the Mihailo Pupin Institute, and Zoran Nakic from David Pajic, the results which have been obtained here will be reevaluated

and supplemented continuously, and the workers will strive to replace imported elements with domestic ones wherever possible. And indeed, the research team can already be commended in this regard. But the greatest achievement will be in the future, never again to get stuck in an elevator or to get angry because the "Elevator Is Out of Order." Mishaps will be infrequent, and when one does take place it will be eliminated in a jiffy. The controller will tell the serviceman precisely where the problem is. This is why the new lifts are called "intelligent." There are many other advantages over the old elevators: "sensors," simpler installation, the tonal announcement of the elevator's arrival at the floor, the encoded transfer of information, the exchange of information and commands, etc.

At the David Pajic agency in Titograd they are preparing for the arrival of the new elevators. They have new showrooms, and six service facilities throughout Crna Gora. In Titograd the factory installers have 238 elevators.

Miladin Kadic, the head of this agency and a young electrical engineering graduate, says that in Crna Gora, especially along the coast, a need has been demonstrated for the installation of all types of the new elevators. This is because the clinical centers and the larger tourist and business buildings in the world cannot be conceived without these elevators. And this means, in other words, that in the future planners must to an even greater extent consider the "pride" of David Pajic.

In closing, what more can be said except that these "intelligent" elevators are just additional proof that we should be using domestic intelligence as much as possible.

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CSO: 2802 / END